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DC Electric Field Observations in the Polar Cusp Region by SS-520-3 Sounding Rocket

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The region called the cusp is near the surface where the lines of magnetic field close. Some physical phenomena are observed in the polar cusp region due to the downward flow of high-energy plasma particles from the solar wind or the magnetosphere. The SS-520-3 rocket was planned to observe the ion heating and acceleration due to the interaction of atmospheric particles and waves over the Arctic region. The SS-520-3 sounding rocket payload is equipped with the Low-Frequency wave Analysis System (LFAS) with two set of orthogonal double probes to measure both DC and AC electric fields in the spin plane of the payload. The Electric Field Detector (EFD) is one of the instruments in the LFAS. The EFD observes the DC electric field and extreme low frequency components of AC electric field. And the EFD also measures the potential difference between the electrode of sensor top and rocket body called the single probe data.

The SS-520-3 sounding rocket was successfully launched at Ny Alesund, Spitsbergen, Norway on November 2021. During the flight, the EFD electronics was normally operating but only two of the four sensors were not normally extended. It was the sensor of the different axis that extended normally. Therefore, it was difficult to derive the component of the DC electric field that was originally planned. However, we found that the DC electric field can be obtained from the single probe data of the extended sensor. As a result, the DC electric field vector was able to derive using the single probe data obtained from the normally extended sensor and the attitude data of the rocket during the flight.

This presentation describes about the derivation of DC electric field vectors using single probe data. And we will discuss the contribution of the DC electric field for the heating and acceleration of the particles in the cusp region by using the measurement result of other instruments onboard the SS-520-3 sounding rocket.